Weapons Advanced Technology Review Boar

Heavy Lift, Analysis Of Alternatives Project
&
Reconfigurable Rotorblade Project

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Heavy Lift Study

- Study Overview
  - Conduct 6 month study for Office of Naval Research exploring the capabilities, technologies, and concepts for future heavy lift systems in the 2020-2025+ timeframe
- Study Objectives
  - Determine capabilities and goals for a heavy lift system
    - Use sources such as Sea Power 21 and Naval Power 21
  - Assess/Rank existing and new concepts
    - Concepts will include: BTC Mono Tilt Rotor and three additional
  - Identify critical technologies and sensitivities
- Study Products
  - Annotated brief documenting study work and results
    - Capabilities, study research, four assessed concepts, and technology sensitivities/gaps

Heavy Lift Study

- Study Coordination
  - Feedback on study plan and assistance with study information has been provided by:
    - PMA-261, OPNAV N75, OPNAV N78, ONR 33, ONR 35, US Army AFDD
  - ONR Program Manager (Lawrence Ash) on OSD Joint Vertical Aircraft Task Force (JVATF)
- Study Tasks
  - Capability Definition
    - Notional capabilities derived from latest USN/USMC doctrine
  - Technology/Concept Investigation
    - Research technologies/concepts that are applicable to heavy lift
  - Conceptual Design
    - Create conceptual designs to meet capabilities
  - Technology Sensitivity Exploration
    - Apply technologies to designs to determine technology sensitivity

Heavy Lift Study

- Current Study Status
  - Concepts and technologies investigation complete
    - Compiled data from contractors and USN/USA organizations
    - Looked at past/present projects
  - Getting ready to down select concepts and technologies to use in the second phase of study
  - Capability Definition
    - Notional performance capability needs are being finalized
    - Analysis defines Expeditionary Maneuver Warfare (EMW)/Assault role and Logistics role at different capability needs and technical challenges
    - Material handling and basing are significant issues
    - Certain capabilities provide near-term improvements via Tactics, Techniques, and Procedures (TTP)

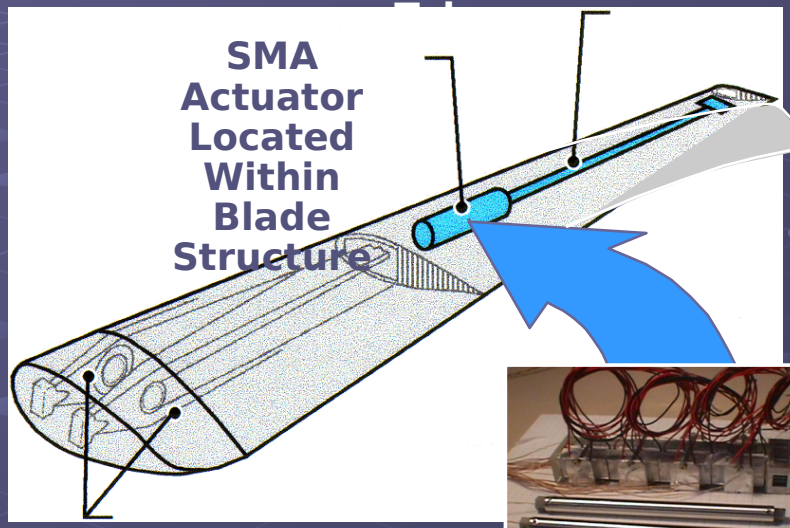
Heavy Lift Study

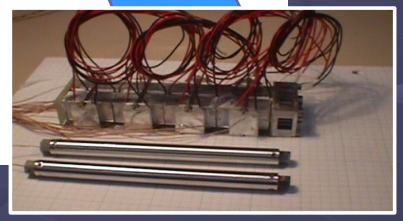
- EMW/Assault Role
  - High tech. challenge
  - Payload Weight:
    - 32 tons / 38 tons
  - Radius:
    - 200 nm / 300 nm
  - Speed:
    - 180 kts / 240 kts
- Logistics Role
  - Medium tech. challenge
  - Payload Weight:
    - 25 tons / 27 tons
  - Radius:
    - 200 nm / 300 nm
  - Speed:
    - 50 kts / 75 kts

Threshold / Objective

Preliminary Trends

Reconfigurable Rotor Blade Project





SMA Actuator Prototype

- In Flight Rotor Blade Steady State Twist Concept With Shape Memory Alloy (SMA) Actuator
  - Potentially enhance rotorcraft performance by 10% to 15% additional lifting capability for the V-22 tiltrotor.
- The Navy is interested in developing and integrating a torsional SMA actuator for a tilt-rotor blade application.

Reconfigurable Rotor Blade Project

- A Nickel-Titanium Alloy, know as NiTinol, is the SMA material used for rotor blade twist actuator.
- The NiTinol actuator is located within the blade spar and attached to a torque tube that spans the length of the rotor blade.
- The NiTinol material must be trained in order to respond in torsion
- When heated, the actuator twists the rotor blade to an optimum blade twist configuration for in-flight rotor blade twist.
- The NiTinol material has two states, Martinsite and Austenite
  - When cold the material is in a Martensite state and is easily deformed
  - When the temperature of the material is raised, the NiTinol material undergoes a transition phase change from Martensite to the Austenite state; which the material has only one possible shape
- Nitinol technology demonstrated by Boeing includes:
  - Nitinol Characterization
  - Component Attachment
  - Locking Mechanism
  - Electronics and Control